Toward new plasma procedure for efficient cleaning of high quality CVD graphene transferred onto SiO_2/Si substrate

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Abstract

The typical manufacturing process for fabricating 2D material devices leaves polymer resist residues on the surface, inducing degradation of their electrical properties [1]. In the case of graphene, it has recently been proposed that H_2 plasma treatment leads to effective dry-etching of this contaminant from CVD graphene grown on Cu [2]. In order to prevent graphene damage, the etching process has been accomplished by using plasma having low ion bombardment energy (< 10 eV for H^+ ions). This work revealed that, under optimized plasma conditions, residue etching occurs mainly in two stages]: (1) fast-etch rate attributed to etching of dense disorganized PMMA macromolecules (called $PMMA^A$) and low-etch rate attributed to lateral etching of 2D-like layers (called $PMMA^G$).
Therefore, for high performance device realization, processing of graphene transferred onto target substrates requires additional control of plasma parameters such as the radical's flux and ion energy distributions. On the other hand, it remains key issues that must be resolved, e.g. low adhesion of graphene on the substrate which makes it vulnerable during the plasma treatment.
In the present contribution, both X-ray photoelectron spectroscopy (XPS) and Raman spectroscopy measurements were carried out on CVD graphene transferred on SiO_2/Si substrates after plasma treatment. We have evaluated the effects of pressure, which allows us to monitor the variation of the ion energy bombardment, by using the high density ICP reactor. The main results will be discussed.

References

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